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INSTALLATION - OPERATION - MAINTENANCE

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IDC

INDUCED DRAFT EVAPORATIVE CONDENSERS

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1.1 Preface

The evaporative-cooled, Induced Draft Condenser (IDC) you have purchased utilizes the finest in engineered design, materials, and corrosion protection to provide a rugged, long-lasting unit. This manual provides the information needed for safe installation, operation, and maintenance. Close attention to the instructions and guidelines provided in this manual will ensure a long satisfactory unit life and dependable operation and performance.

Before rigging or beginning work on the unit, Imeco recommends that experienced Refrigeration contractors, operators, and maintenance technicians be formally trained on the IDC design and features - with this manual's reading as a **minimum** requirement. After installation, the unit (as selected) must also be properly connected to appropriately designed and installed refrigeration and water treatment systems. The engineering plans, piping layouts, etc. for the IDC and associated system components must be detailed in accordance with local/governing codes and the best industry standards and practices such as those outlined in up-to-date industry literature.

Should you have any comments or questions regarding this manual or the IDC unit, you are urged to call your local sales representative.

1.2 Shipment Inspection

Upon arrival of the IDC condenser at the job site, the unit should not be signed for until it is inspected to ensure that all required parts have been received and are free of shipping damage. Unpack all items and check against shipping lists - any items that appears to be missing should be noted on the shipping papers and reported to an Imeco representative. The following parts should be inspected:

- Sheaves, belts, bearings/supports
- Fan blades, shaft, and motor/hood
- Coil/s and water distribution spray header, pump, strainers, and float assembly
- Drift eliminators and inlet louvers
- Parts shipped loose in pan section

Parts shipped loose include fan guard, inlet louvers, assorted nuts, bolts, washers, and mastic strip (a flexible joint seal stored on a continuous paper-backed roll). Accessory items will likely be shipped "loose" in a sealed box that is secured in the pan section.

1.3 Transit Damage Claims

The IDC unit owner's authorized agent who signs for the shipment is responsible for making damage claims (per ICC requirement). Request immediate inspection and form execution by the agent of the carrier. Contact YORK Refrigeration Systems (815-288-3859) to report damage or shortage claims.

1.4 Unit Identification

All IDC units are identified by a nameplate permanently attached to the pan section. **Figure 1-1. ID Plate Information** shows the information provided. Imeco recommends that the name plate data be copied onto the graphic for ease of reference ordering parts.

NOTE: When inquiring about the unit or ordering repair parts, provide the MODEL and SERIAL NUMBERS from the data plates.

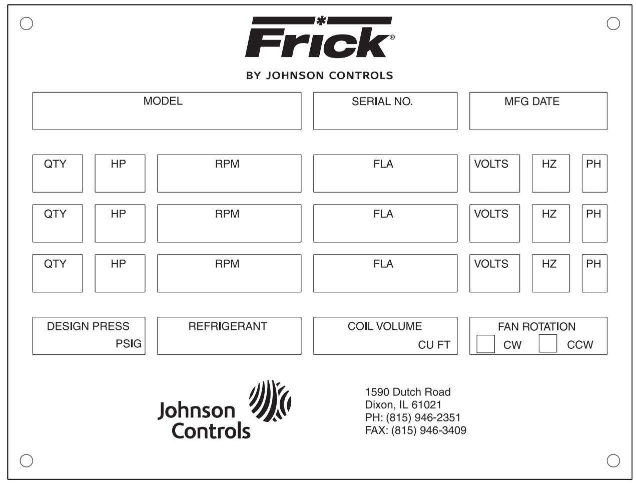


Figure 1-1. ID Plate Information

1.5 Safety Requirements

IDC unit installation, operation, and maintenance – involves heavy rotating machinery operating at high speed and high voltage. Normal operations and maintenance procedures may require working at elevations, enclosed space entry, or use of hand and power tools. With these considerations, safety must be the top priority in all activities with this evaporative cooling product.

Imeco recommends that every client analyze and develop an installation-specific safety regime that takes into account such variables as specific site/system features, personnel qualifications, hazard identification, etc. The following elements of operational safety are recommended for inclusion in every client's IDC condenser safety plan/requirements:

Electric: Configure all power switches and controls to provide an open, safe circuit before and during maintenance procedures, until the unit is cleared by management for normal on-line operations. For extended shutdowns it is recommended that a qualified technician remove fuses from "fused-disconnect panels" or otherwise open the circuit in an accepted, secure manner.

Fans - All fan covers, guards, and shaft retainers (if any) must be in place before applying power to an IDC condenser. Always disengage and lock out power before allowing interior inspections. To prevent foreign objects from being drawn into rotating fan blades, **never** allow operation with hatch off/open.

Enclosed space inspections – Inspections of condenser coil, drift eliminators, etc., requires machinery lockout and the use of a "lookout buddy" at a minimum. Consult your internal safety policy and OSHA requirements for additional safety rules/procedures.

Vibration and noise – Discontinue or stop machinery that emits unusual vibration and noise. The source must be investigated (and apparent discrepancies corrected) before testing or placing the unit back in operation.

Wet Surface Precautions – Poorly maintained/wetted machinery requires care to avoid electrical shocks from inadequate/loose field wiring/connections. All personnel must lock out and tag machinery before working on the condenser. Proper safety precautions such as the use of insulating soles/gloves and a trained "lookout buddy" are indispensable. Ice formation in cold weather can present fall/slip hazards. Icing safety procedures should be mandatory when the daily ambient temperature falls below 40°F (4.4°C).

Water Chemistry – All evaporative-cooled condensers operate on principles that encourage biological growth in the recirculating water unless effective treatment is applied. Recirculating water must be periodically analyzed for biological culture plate counts. IDC units should not be operated without an effective biological treatment program.

NOTE: Emergency "shock" treatment with chemical biocides may upset the unit's appropriate pH range (creating an excessively corrosive environment for the materials of construction) and may expose operators to strong chemicals that are corrosive or otherwise dangerous if mishandled (see water treatment page in Section 4.0).

1.6 Placement of IDC Units

All IDC units must be located to minimize the effect of exhaust air recirculation. This can significantly derate an evaporative-cooled IDC's capacity due to the exhaust air's relatively higher heat and moisture (gained from evaporation of tower water).

In some worst case scenarios, up to 30% heat removal capacity can be lost if a cooling tower is improperly located or oriented. It is the owner's responsibility to properly locate each unit and/or consult with a qualified engineer before laying out structural/foundation supports and installing the IDC condenser.

Adequate space must be continuously available to allow adequate airflow to the IDC inlet louvers to prevent discharge air recirculation. **Figure 1-2. IDC (Unit to Unit Spacing Requirements)** shows IDC condensers on an open roof with the minimum required distance between the units.

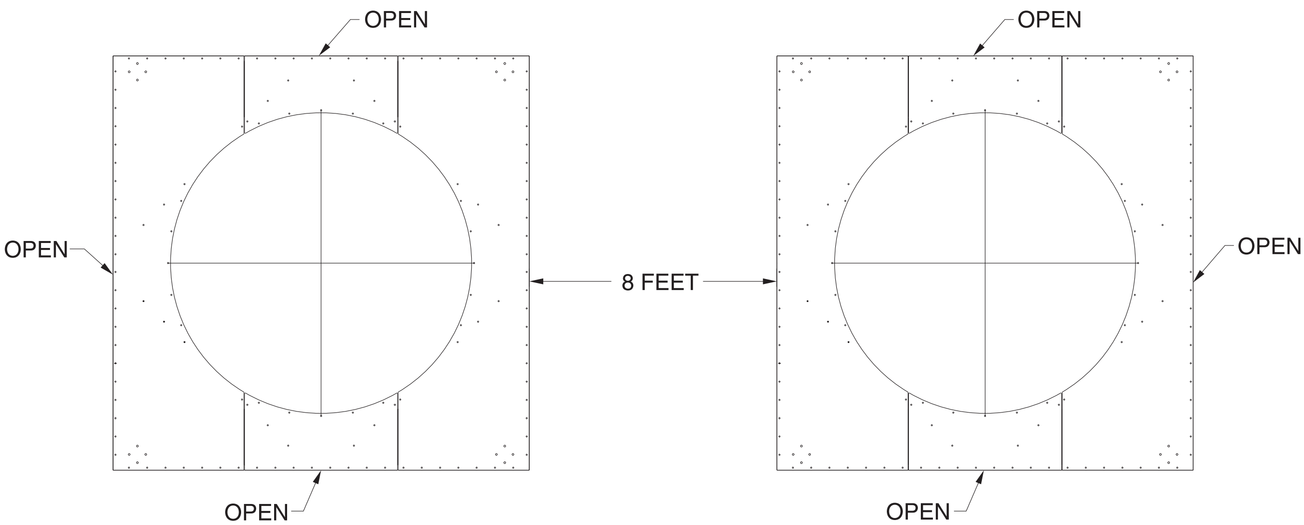
In general, IDC unit/s should always be located/elevated on concrete pads, piers or structural steel so that exhaust air discharge of the fan orifice is at or above the elevation of nearby walls or structures/equipment.

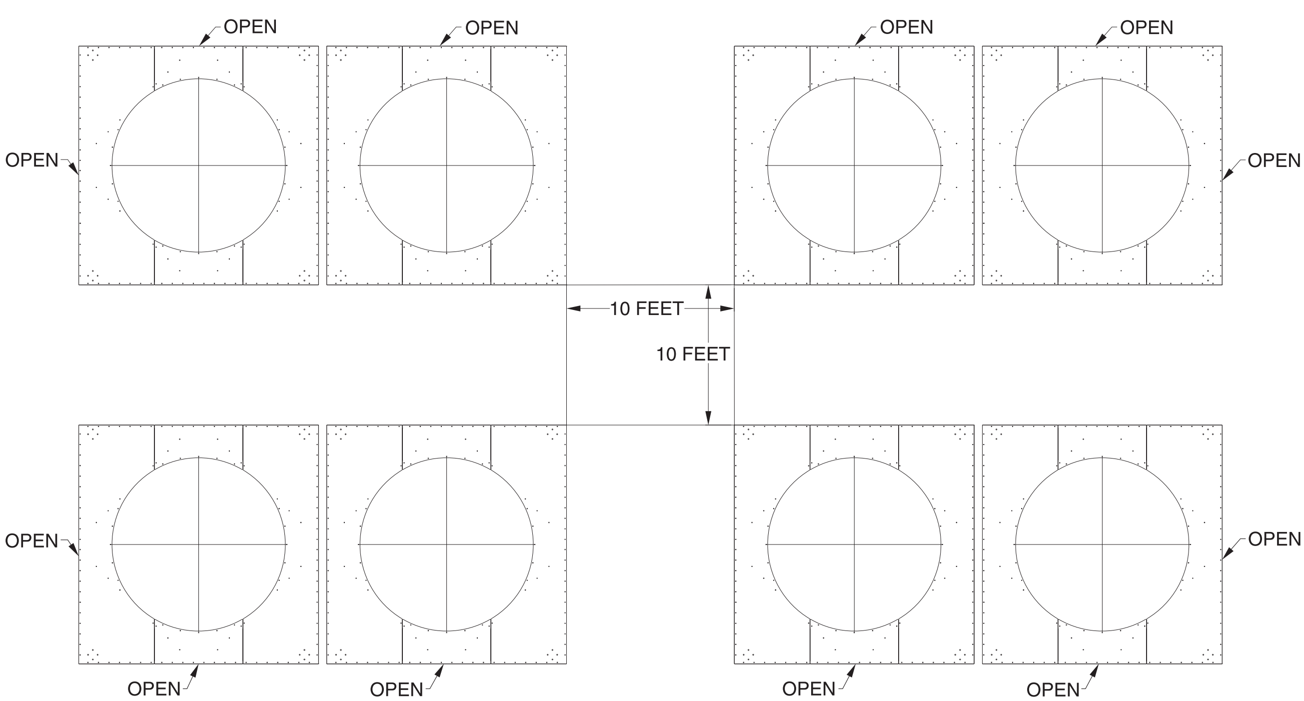
For other minimum spacing requirements see **Figure 1-3. (IDC Unit/s to Wall Spacing Requirements)** for examples showing (2) IDC condensers installed next to a single wall and next to a double wall; and, (1) multiple-cell IDC condenser installed next to a double wall.

1.7 Field Piping Considerations for IDC Unit Installation

All IDC units require strongly supported and anchored field piping. No field piping is to be supported by the IDC itself. Wind loading, temperature variation, etc., must be considered to allow for movement between the tower, building, optional vibration isolator/rails, and field piping. A qualified cooling system design engineer should provide final field-piping plans and specifications.

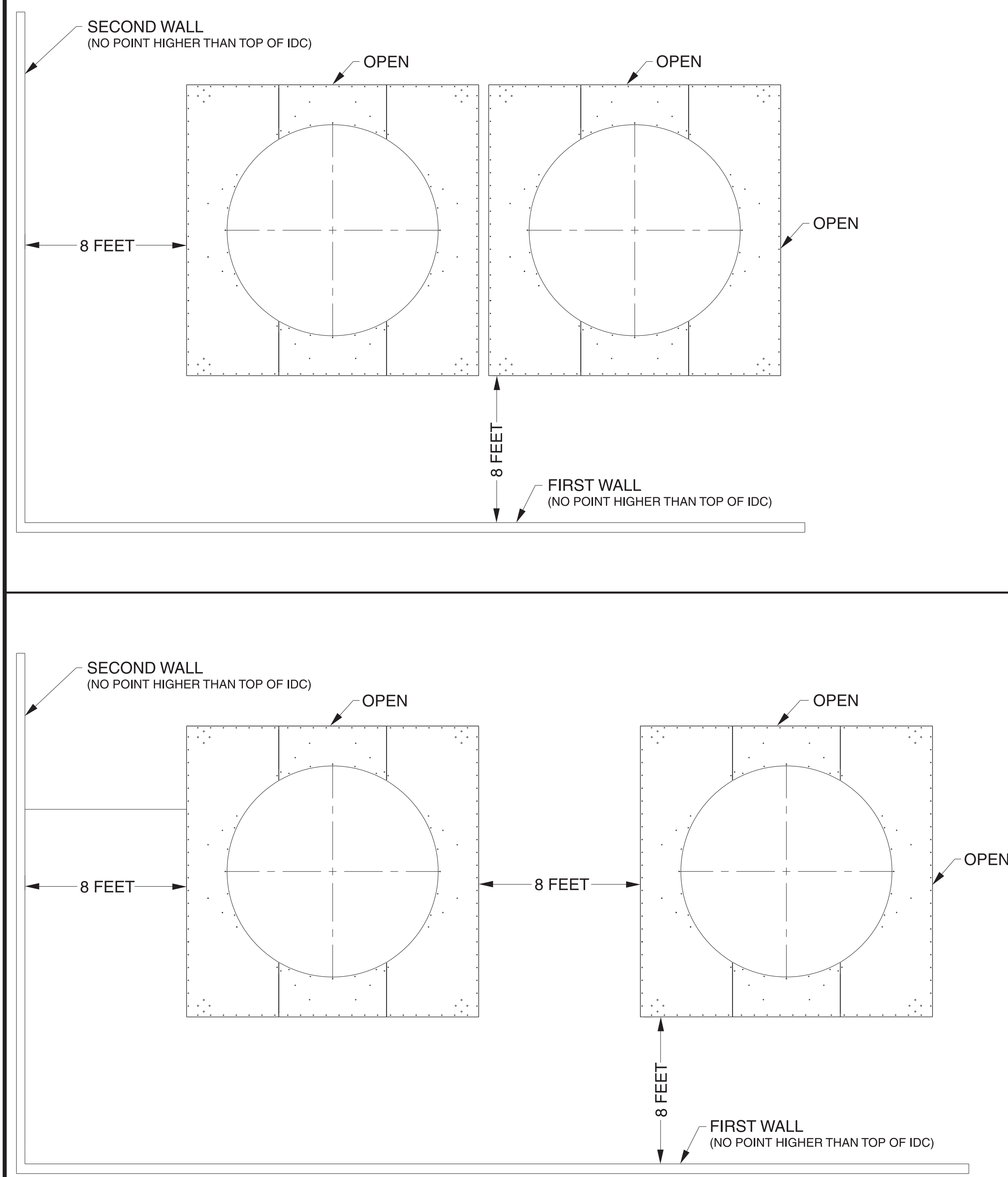
Before finalizing piping installation plans, it is recommended that related plans for cooling system/plant expansion be discussed with your field piping/system designer and Imeco sales representative. Incorporating pipe openings/sizes now allows for easier installation in the future.





MULTIPLE CELL AND MULTIPLE UNIT INSTALLATION

Figure 1-2. IDC Unit-to-Unit Spacing Requirements



MULTIPLE CELL AND MULTIPLE UNIT INSTALLATION

Figure 1-3. IDC Unit-to-Wall Spacing Requirements (Multiple Cell and Multiple Unit Installation)

Section 2.0 Installation Procedures

Installation of an IDC unit involves constructing heavy foundations and/or structural steel supports as well as erecting and anchoring the unit. Imeco strongly recommends that a qualified, bonded, and insured mechanical general contractor be used to perform this heavy structural work.

As a crane is generally required, it is advisable to clear the access area a day in advance to ensure smooth and safe operations the day of the lift. Once the IDC unit is set in position and the crane drops its hook, it is the client's responsibility to ensure that the IDC is made safe with permanent anchoring to a solid foundation.

The project site should be surveyed periodically to ensure that no unattended IDC components or contractor materials/tools remain unsecured. Electrical work should also be made safe against unauthorized site visitors, vandalism, or weather.

2.1 Installation Tools

To complete the installation of Induced Draft Condenser (IDC) evaporative cooling unit/s, the following tools are needed at a minimum:

- Drift pins
- 8-foot straight edge
- Level
- Assorted open-end wrenches
- Socket set
- Belt tension gage
- Tape measure

2.2 Foundation Information

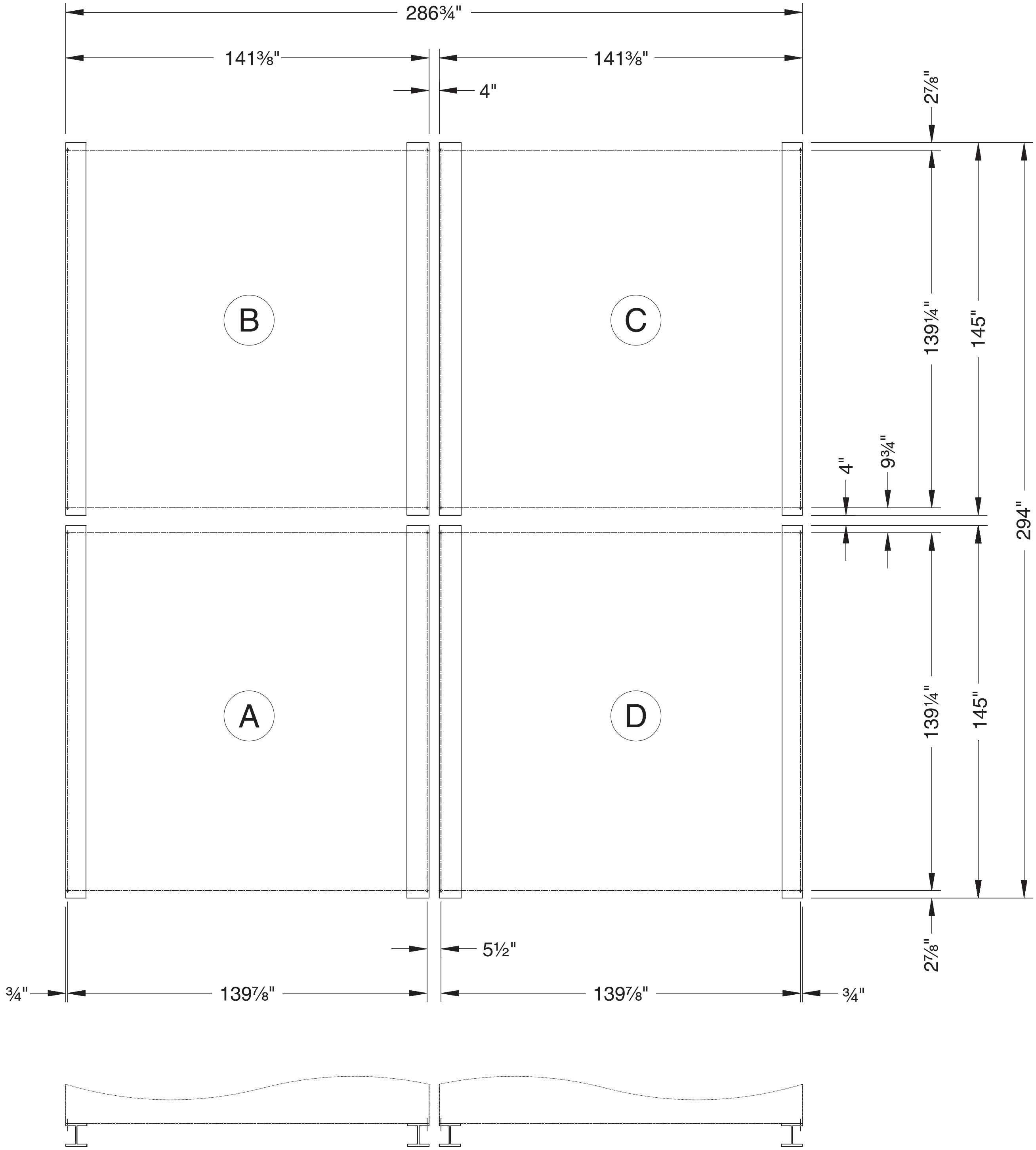
IDC units are shipped in two pieces, a pan section and the fan/coil section. As the unit's base, the pan section must first be anchored to suitable "footings": concrete pads; concrete piers; or structural steel capable of supporting the total unit **operating** weight **plus** a significant **safety margin** as determined by a qualified structural engineer. Support "footing" requirements will vary with live loads (expected snow/ice buildup) as will related anchoring requirements for resisting seismic and wind loads.

Two IDC units support "foundation footings" are required, one located under each end of the unit with both running the full width of the unit - reference **Figure 2-1. Foundation Layout**.

If the support "footings" are in the form of two steel beams, each should be sized in accordance with standard engineering practices. Structural design should account for 55% of the operating weight of the unit as a uniform load on the beam, allowing for a maximum deflection of 1/360 of the length, not to exceed 1/2 inch.

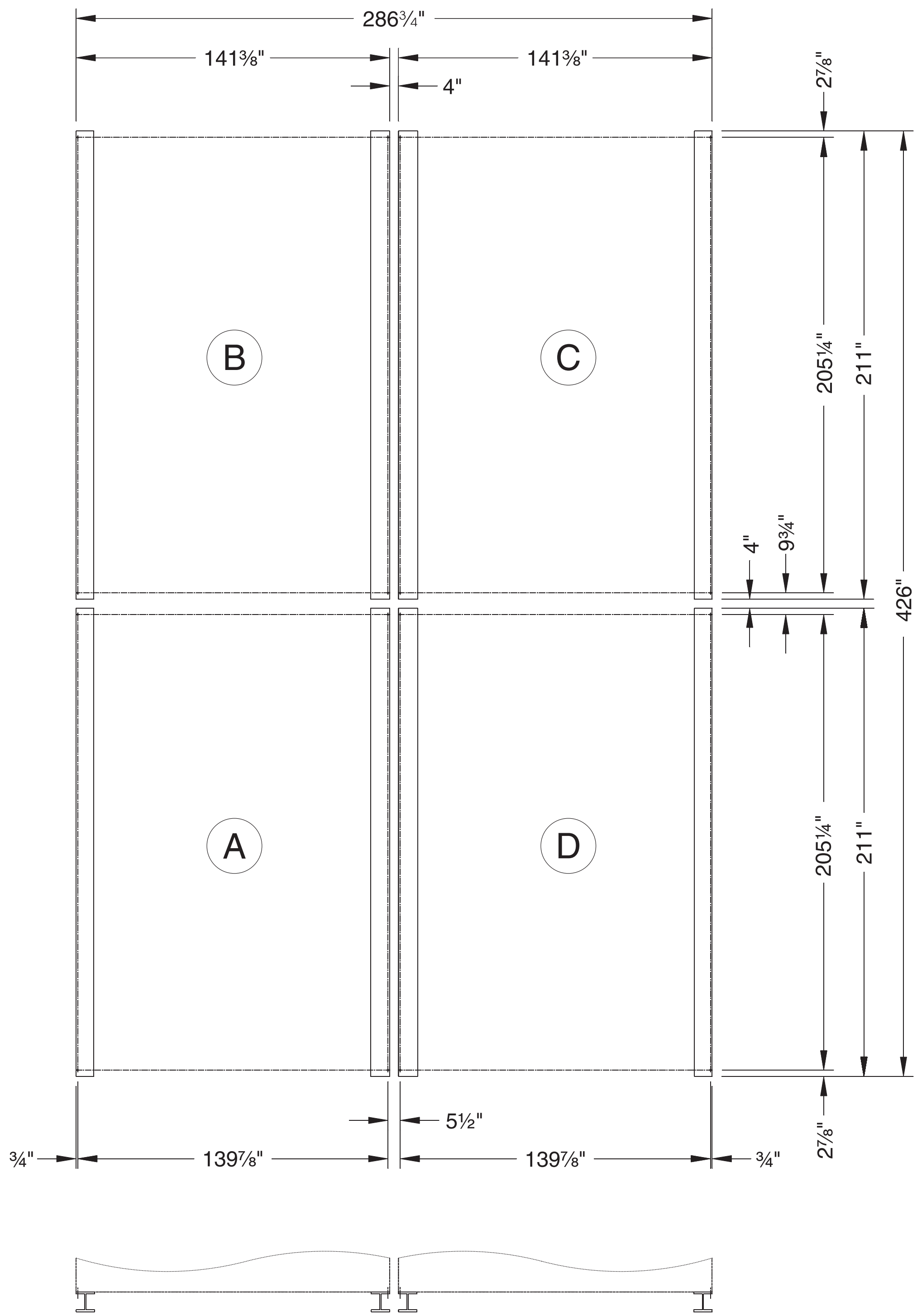
All units have holes for the use of appropriate beam "footing" anchors/connections such as epoxy-bolts, metal concrete fasteners, or direct welds to structural steel beams. Structural beams need to be shimmed level before final anchoring.

NOTE: Shims between the beams and the unit should not be used, as this will not provide adequate support.



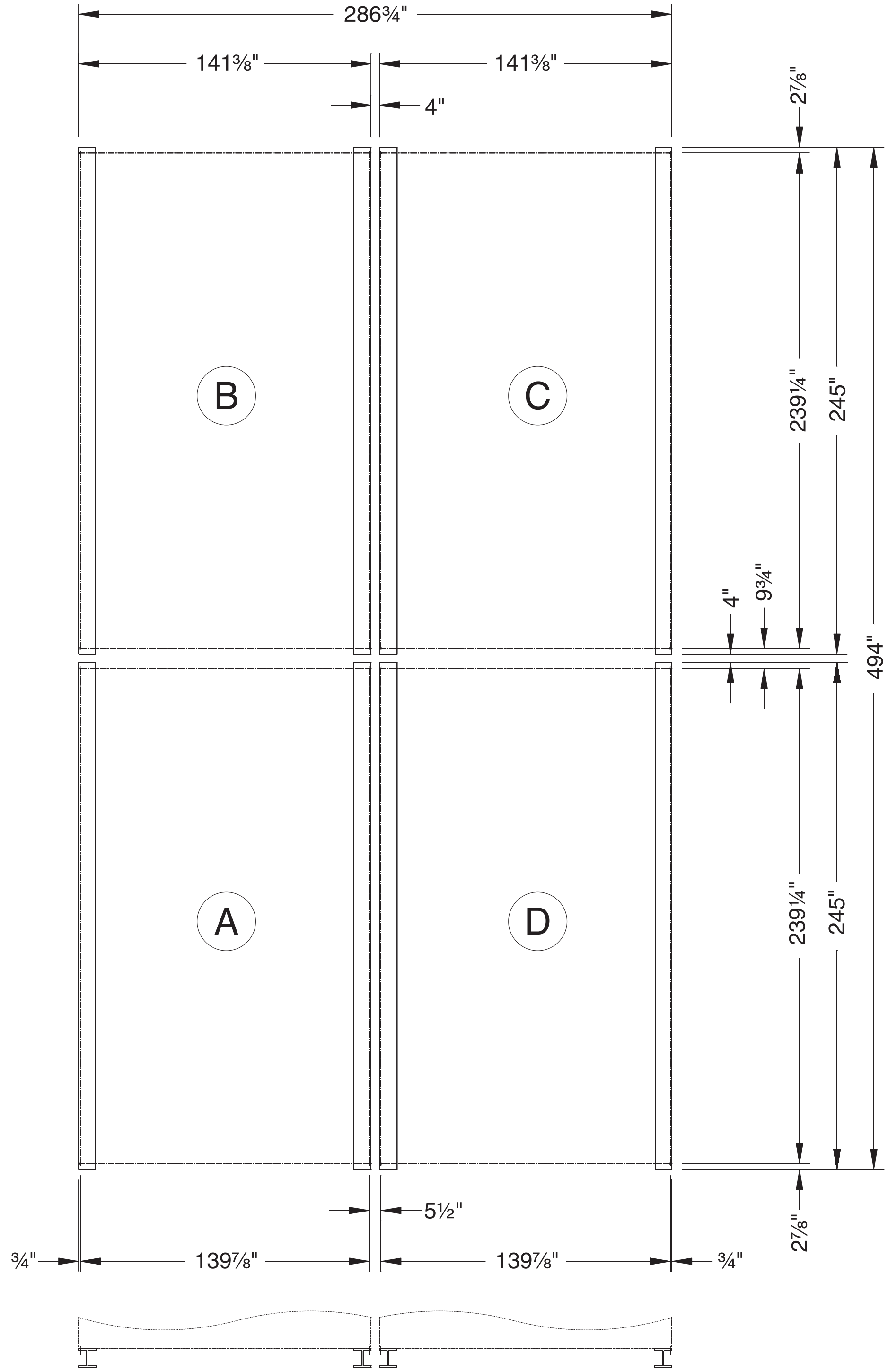
		OVERALL	
MODEL	**APPLICABLE CELLS**	**LENGTH**	**WIDTH**
420 – 540	A	145"	141⅜"
840-2S – 1080-2S	A, D	145"	286¾"
840-2E – 1080-2E	A, B	294"	141⅜"
1620-4Q – 2080-4Q	A, B, C, D	294"	286¾"

Figure 2-1a. 12′ x 12′ Foundation Layout



		OVERALL	
MODEL	APPLICABLE CELLS	LENGTH	WIDTH
575 – 835	A	211"	141⅜"
1120-2S – 1620-2S	A, D	211"	286¾"
1150-2E – 1670-2E	A, B	426"	141⅜"
2190-4Q – 3170-4Q	A, B, C, D	426"	286¾"

Figure 2-1b. 12′ x 18′ Foundation Layout



		OVERALL	
MODEL	APPLICABLE CELLS	LENGTH	WIDTH
870 – 990	A	245"	141⅜"
1690-2S – 1920-2S	A, D	245"	286¾"
1740-2E – 1980-2E	A, B	494"	141⅜"
3270-4Q – 3740-4Q	A, B, C, D	494"	286¾"

Figure 2-1c. 12′ x 20′ Foundation Layout

2.3 Eliminator Placement

Check the placement of the eliminator sections for proper interlock and eliminate openings, which will allow the escape of water droplets. Check the orientation of the eliminator sections to ensure "RIGHT SIDE UP" as shown in **Figure 2-2. Eliminator Orientation Cross Section**. Eliminator placement is described in greater detail in Section 4 - Maintenance.

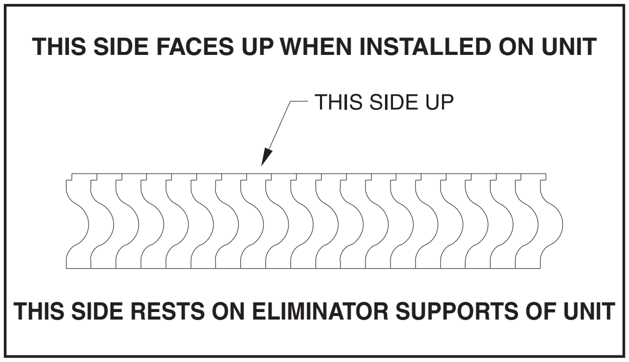


Figure 2-2. Eliminator Orientation Cross Section

2.4 Inlet Louver Installation

Install inlet air louvers so that water drains into unit. Louvers are shipped within the drain pan. Orient the louvers as shown in **Figure 2-3 Louver Installation**. A slotted holding bracket slides up to install the louver. The bracket then slides down to be tightened. It will hold the louvers in place.

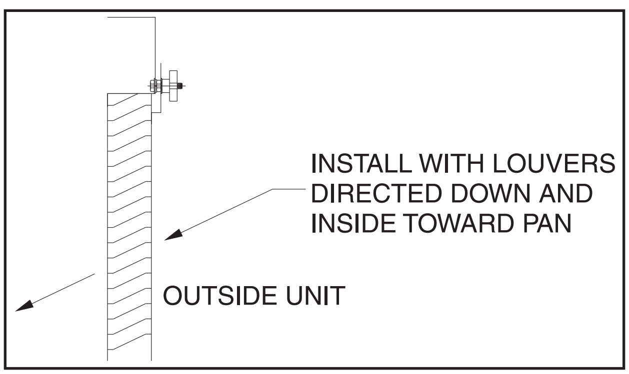


Figure 2-3. Louver Installation

2.5 Erecting the IDC Unit

As mentioned above, the pan section is first hoisted into place and secured to prepared "foundation beams" with appropriate anchoring hardware. Following this procedure, the Coil/fan Section is hoisted into position and bolted to the Pan Section's support posts.

NOTE: **lifting-cable length is critical as shown in the rigging of the two sections in Figure 2-4 (a-b). Assembly and Placement**.

ERECTION NOTES:

1. For extended lifts, use all lifting points and safety slings. For final placement, use all lifting points.
2. Use spreaders and blocking to protect the flanges of the casing and prevent caving in sides.
3. All safety precautions should be vigilantly enforced while crane is on site. Only properly trained members of the crane's crew should handle hook cables, slings, spreaders, etc.

2.6 Optional Vibration Isolator

Vibration isolators minimize transfer of forces due to vibration/dynamic loading to or from IDC unit/s. This IDC unit option requires additional field installation measures.

If vibration isolation is provided (whether furnished by Imeco or by others) the isolators must always be mounted below the condenser unit structural "I" beam supports (such that continuous support of unit, as described above, is provided). Refer to **Figures 2-5 (a-b) Vibration Isolator Installation** and the following instructions:

ISOLATOR FEET INSTALLATION:

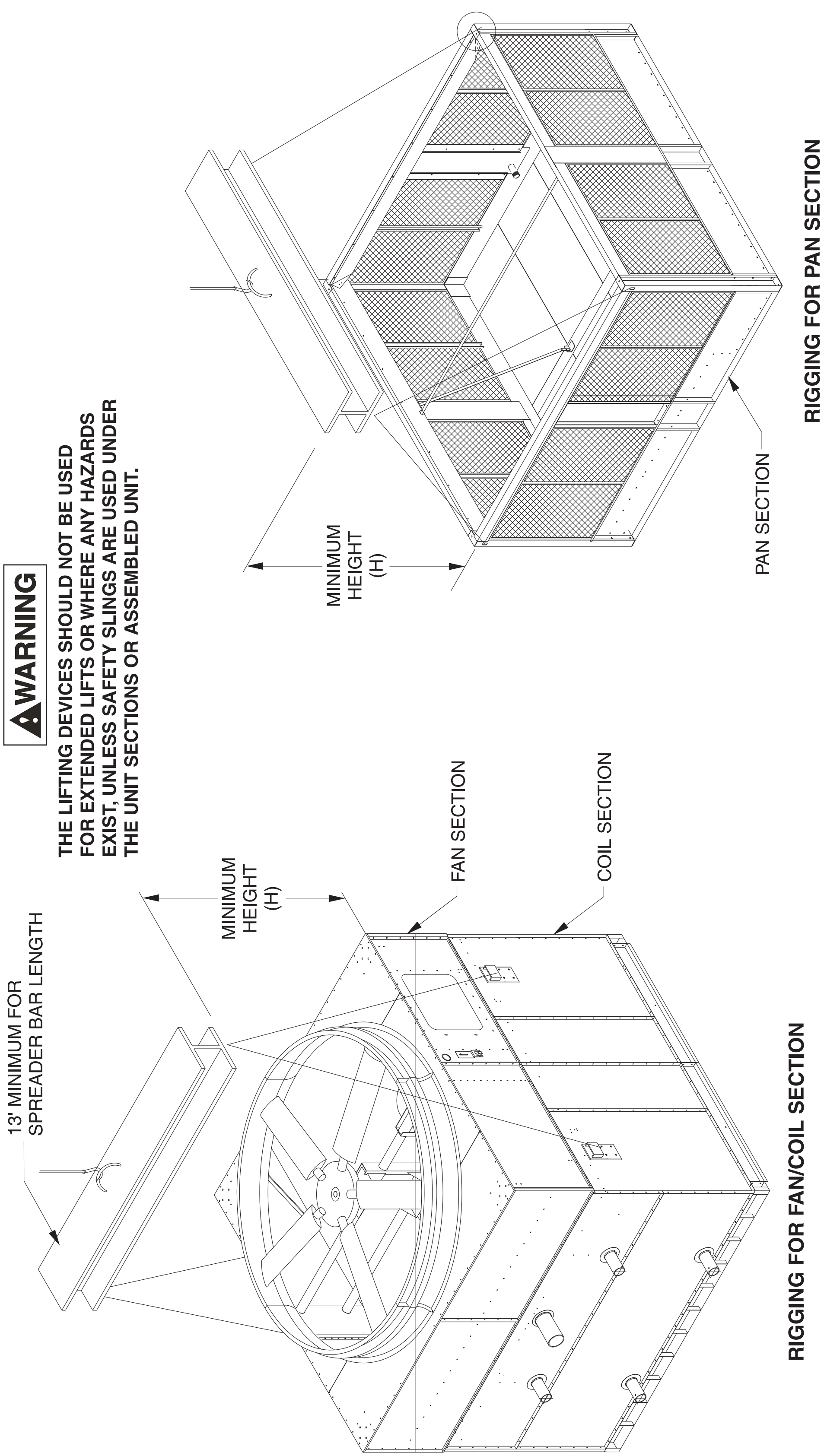
1. Refer to the submitted foundation layout drawing for the correct location of each isolator and support beams.
2. Place the isolators in their proper location and attach the bottom plate to the building support steel by means of bolting or welding.
3. Set unit support beams on top of the isolators and attach them to the top plate by means of bolting or welding.
4. Lower the first section of the unit onto the beams, taking care not to overload any one corner.
5. Attach unit to the beam by means of bolting or welding.
6. Continue to attach the remaining unit sections per the instructions on the previous pages and complete piping, wiring, etc.
7. Loosen the vertical restraint jam nuts to the end of the restraint bolts.
8. When the unit is completely installed and operating, turn the leveling bolts counterclockwise several complete turns on each isolator until the blocking channel can be removed by hand. In order to raise the unit uniformly, it will be necessary to alternate between isolators. Do not attempt to place all the weight on any one isolator, but distribute the load proportionally.
9. After the unit is level, tighten the vertical restraining nuts finger tight, then back off one half turn. Lock each nut with the jam nuts provided.

ISOLATOR RAIL INSTALLATION

1. Refer to the submitted foundation layout drawing for the correct location of each isolator rail.
2. Place the isolator rail assemblies in their proper location and attach the bottom plate to the building support steel by means of bolting or welding.
3. Lower the first section of the unit onto the rails, taking care not to overload any one corner.
4. Attach the unit to the isolator rail by means of bolting or welding.
5. Continue to attach the remaining unit sections per the instructions on the following pages and complete piping, wiring, etc.
6. Temporarily remove all vertical locknuts from hold-down bolt.
7. When the unit is completely installed and operating, turn the leveling nuts clockwise several complete turns on each isolator until the shim can be removed by hand. It will be necessary to alternate turns on each isolator to uniformly raise the unit. Do not attempt to place all the weight on any one isolator, but distribute the load proportionally.
8. After the unit is level, replace all vertical locknuts on hold-down bolts and fasten finger tight.

⚠ WARNING

THE LIFTING DEVICES SHOULD NOT BE USED FOR EXTENDED LIFTS OR WHERE ANY HAZARDS EXIST, UNLESS SAFETY SLINGS ARE USED UNDER THE UNIT SECTIONS OR ASSEMBLED UNIT.



NOTES:

1. The hook of the crane must be a minimum height above the top of the section being lifted to prevent excessive strain on the lifters.
2. Safety slings and skidding should be removed before assembling the sections together.
3. To minimize wind loads during extended lifts, remove the louvers.

Figure 2-4a. Assembly and Placement

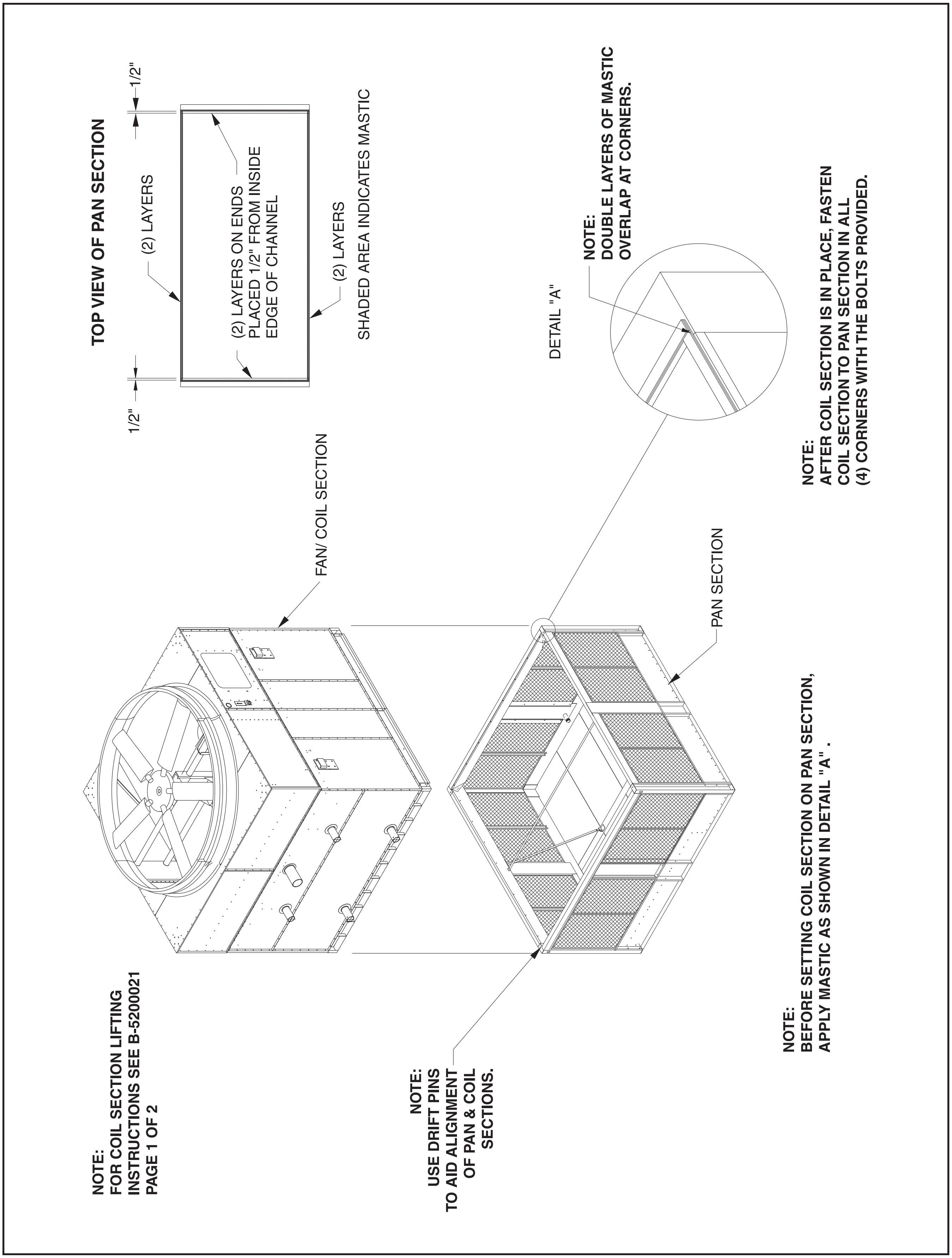


Figure 2-4b. Assembly and Placement

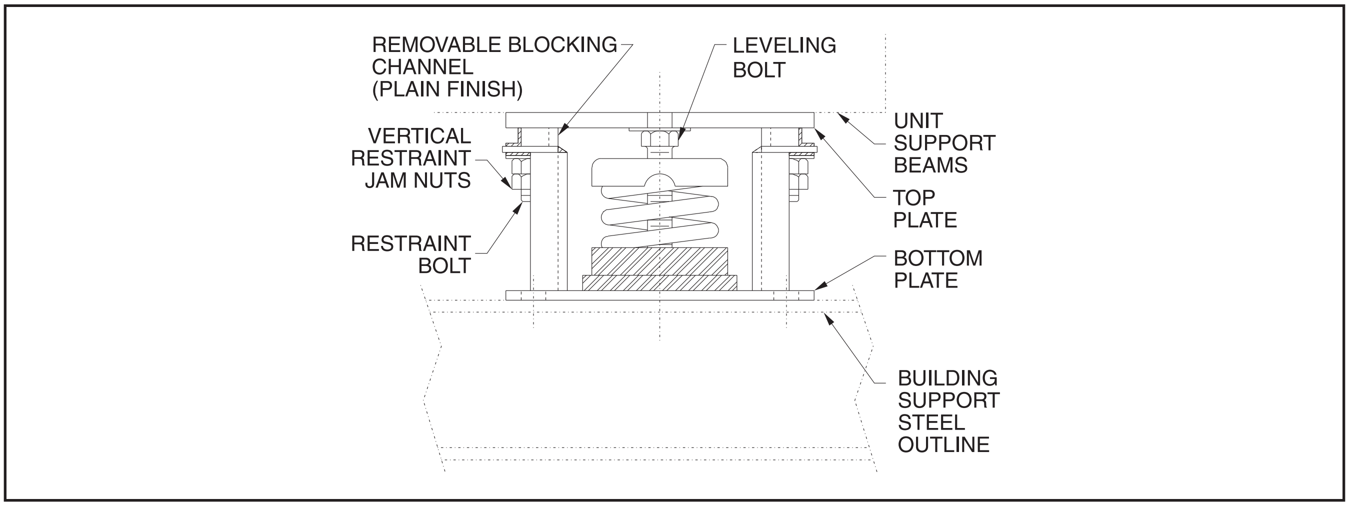


Figure 2-5a. Vibration Isolator Feet

NOTE: Do not attempt to move the unit laterally with the weight on the isolators. If it is necessary to move the unit, remove the weight from the isolators by raising the unit before moving. Failure to follow this procedure could result in damage to the isolator.

Do not use ridged connections between the unit and building structure when using vibration isolators. Use flexible connections that allow for vibration and noise isolation.

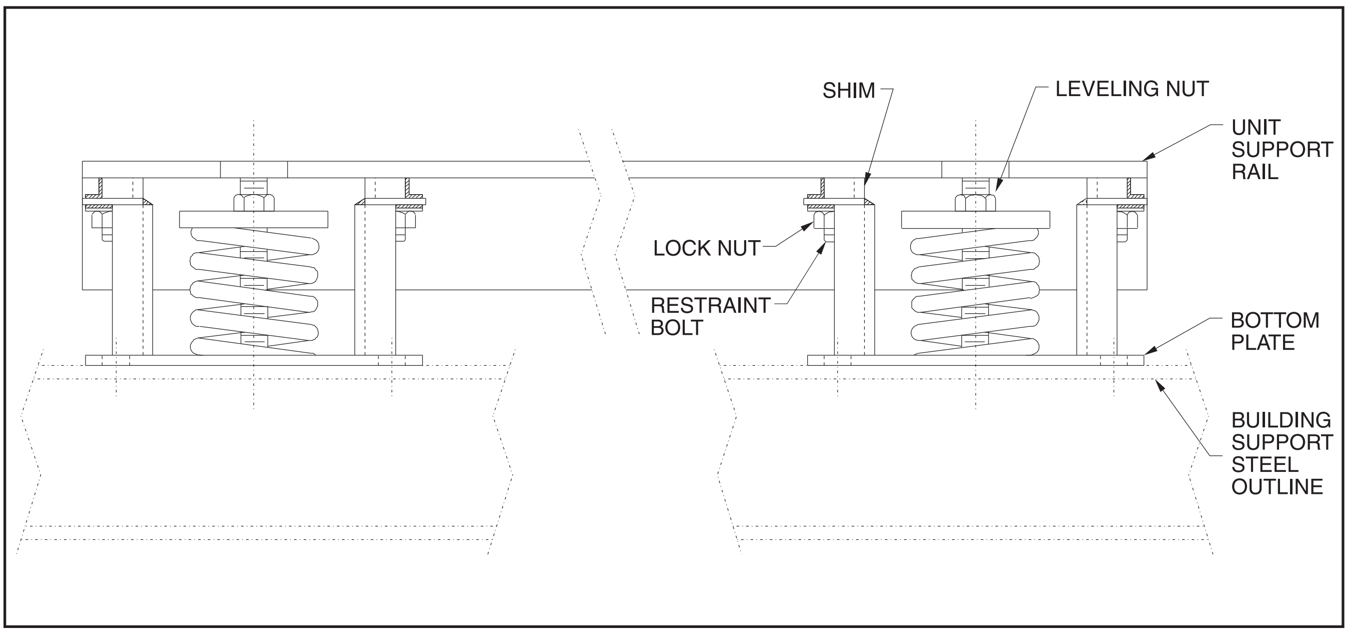


Figure 2-5b. Vibration Isolator Rails

Section 3.0 Start-up & Operation

Before attempting to start-up and operate any electrical cooling equipment such as an IDC condenser unit, it is essential that all personnel associated with have a basic knowledge of how and why the unit operates in normal conditions. The following description outlines a standard unit's general features, operation, and controls.

An IDC (Induced Draft Condenser) is an engineered heat transfer device that uses a fine water spray and counter-current airflow to evaporative-cool a "coil" (continuous tubing bundle). Heat is transferred to the spray's water film on the outside coil surface from a gas flowing inside the coil. The gas stream ultimately condenses when its heat load is fully transferred. The transferred heat load evaporates a small part of the water stream before the remaining water is collected and recirculated.

The water "film" that is sprayed over the outside of the coil gravity-feeds into a basin "pan section" located at the bottom of the IDC unit. A "recirculation" pump collects and discharges the water at a given pressure to the spray distribution piping header "tree" and nozzles that are arranged in an opposed flow arrangement for even spray coverage over the coil assembly.

Located on the top of the IDC unit is an induced-draft, axial-flow fan that is indirectly driven by an electric motor which uses sheaves and a multi-band belt for power reduction/transmission. The fan draws fresh intake air through side louvers and up through the coil (counter-flow to the falling water stream).

Heat and moisture-laden air is then passed through a drift eliminator to remove entrained droplets. Air then flows through the air plenum, fan, fan orifice, and fan guard before exhausting to atmosphere.

Safeties and controls vary with each IDC installation and may be interfaced with ancillary equipment or system controls. Since all operators should be thoroughly trained in an integrated cooling system's sequence of operations, each client should develop their own control description.

3.1 Initial Start-up (for new IDC Units)

After installation of the unit, controls, and necessary ancillary/auxiliary equipment, the entire cooling system should be prepared before placing the unit on-line for the first time. Specifically, the following prestart measures must be completed satisfactorily to ensure readiness of the IDC.

NOTE: Do not attempt any inspection or maintenance unless the electrical supply has been completely disconnected and locked out.

Inspection

Do not start the unit until the following inspections prove operational readiness. Avoid accidents or equipment failure by rectifying any unsatisfactory condition.

1. Inspect general condition of unit, e.g., structural integrity, anchors/supports, etc.
2. Confirm drive assembly condition and alignment of motor, bearings/collars, and fan/shaft.
3. Confirm proper belt condition and tension. (See Maintenance Section 4.4)
4. Check condenser for any damage, or blockage that may impede water flow. Check all flow controls such as basin heaters, makeup valves, thermostats, etc.
5. Confirm "sump" level is at proper level. (Section 3.2.8)
6. Check fans and guards for obstructions.
7. Clean and flush pan and strainer. (Section 4.5)
8. Check fan/s for correct rotation and electrical hookup.
9. Understand and prepare for first 24 hour operation measures e.g., new belt run-in procedures. (Section 3.3)

Breaking In Galvanized Surfaces

A proper break-in procedure should be followed for water treatment based on allowing the galvanized surfaces to break in (passivate). Properly executed, this allows galvanized surfaces to form a self-protecting zinc carbonate layer. A qualified water treatment specialist can provide specific details, but the following are **minimum** guidelines.

1. Clean all wetted surfaces.
2. Touch up scratches in the galvanizing with a zinc rich compound.
3. Keep the water as close to neutral (pH=7.0) as possible. It must be between 6.5 and 7.5 at all times during the break-in period.
4. Avoid cleaning chemicals in pH ranges above 8.0 and below 6.0.
5. Operate under minimal load during the break-in period. When the unit is installed, the water can be circulated through the unit before the refrigerant piping is connected to begin the passivation process.

Begin regular water treatment procedures after a break-in period, typically 30-45 days.

3.2 Initial and Seasonal Start-Up

Before initial start-up or after a long shutdown period, the unit should be thoroughly inspected and cleaned. The start-up sequence should be:

1. Clean any debris from guards, fans, eliminators, heat transfer coil, and cold water basin.
2. Flush the cold water sump (WITH STRAINERS IN PLACE) and drain to remove accumulated dirt. (Section 4.5)
3. Remove, clean, and replace sump strainers.
4. Turn the fan(s) by hand to ensure rotation without obstruction.
5. Check and, if necessary, adjust the fan belt tension. (Section 4.4)
6. Prior to seasonal start-up, lubricate the fan shaft and motor bearings. The ball bearings are factory lubricated, but should be relubricated if the unit has been sitting on site for more than a year before start-up.
7. Check float-operated makeup valve to be sure it is operating freely.
8. Fill cold water sump with fresh water to overflow level (start basin heater if necessary).
9. Adjust the float on the makeup valve to shut off the valve when the float is approximately even with the centerline of the overflow.
10. Start spray pump and check for the proper rotation as indicated by sticker on pump motor. On "Remote" installations where the unit pump was not furnished by the factory, water flow must be at the flow rate and pressure shown on submittal drawing.
11. Inspect spray nozzles and heat transfer section.
12. Check the locking collar on each fan shaft bearing and tighten if necessary.
13. Check the voltage and current of all three legs of the fan and pump motors. The current should not exceed the rated service factor. After prolonged shutdowns, the

motor insulation should be checked with a Megger Tester prior to restarting the motors.

14. Start the fan(s) and check for proper rotation as indicated by sticker on unit.
15. Open the bleed line valve and adjust bleed to the recommended rate. (Section 4.9).
16. On units furnished with electric water level control packages, ensure that the stilling chamber is free of obstructions.

3.3 24-Hour Run In

After 24 hours of operation under load, the following services should be performed:

1. Check unit for any unusual noise or vibration.
2. Check the operating water level in the cold water sump. Adjust if necessary.
3. Readjust fan belt tension if required.
4. Inspect spray nozzles and heat transfer section.

3.4 Daily Operation

The unit should be inspected, cleaned, and lubricated on a periodic basis. The required services and recommended frequency for each are summarized in the Operation and Maintenance Schedule in this manual.

A daily IDC operations log is a good method to assure that no problems develop that may go unchecked. Entries to this "rough" log should be made once each shift. Any notations should be entered as they occur (or internal policy dictates). It is essential that the maintenance manager examine notations (from the previous 24 hours) on a daily basis.

As safety/weather dictates, a visual check of the condenser should be made once each shift (daily at a minimum) to check operating conditions. Unusual leaks, noise, vibration, part damage/failures, or vandalism should be logged immediately. Corrective action should be initiated immediately as operations permit, or ensuing service scheduled.

Associated equipment should also be part of the daily operational checks for the IDC unit. In particular, filtration and other water treatment equipment performance are important to satisfactory and problem-free unit operation.

3.5 Seasonal Start-up & Shutdown

Since the IDC is exposed to freezing conditions and other natural stresses, it is mandatory that maintenance personnel conduct a thorough shutdown and start-up on a given date each year (before freezing or high heat loads cause problems for an unprepared unit.

Seasonal Shutdown

The following services should be performed when the unit is to be shutdown for a prolonged period:

1. Clean and flush the cold water sump with sump strainer in place. Leave the drain open so rain and melting snow will drain from the unit.
2. Clean the sump strainers and reinstall.
3. Drain the cold water sump and all piping that will be exposed to freezing temperatures.
4. Lubricate the fan shaft and motor bearings, motor base and motor base adjusting screws.
5. Close shutoff valve in water makeup line and drain all exposed makeup piping.
6. Inspect the protective finish on the unit. Clean and refinish as required.
7. On units equipped with electric water level control packages, inspect stilling chamber to ensure it is free of obstructions.

Seasonal Start-up

1. Remove freeze protection and fill water sump, exposed piping, etc.
2. Ensure that basin heater or heat taping is turned off by thermostat settings or manually
3. Open makeup valve and test flow to IDC makeup valve.
4. Test makeup valve shutoff.
5. Check fan for obstructions and rotate by hand to check for binding
6. Relubricate fan and pump bearings
7. Remove debris from all exposed surfaces, louvers, and fan guard.
8. Clean coil tubes, fins, etc., for good heat transfer
9. Prime the recirculation pump and observe flow through the pipe tree.

3.6 Winter Operations

Evaporative condensers are suitable for most cold weather applications when supplied with proper capacity control and freeze protection. Ultimate freeze protection in harsh climates means keeping the basin pan water heated and cooling the dry coil with the fan only. In more moderate temperatures the IDC may be used with the recirculation pump back in operation to achieve evaporative cooling.

NOTE: dry-bulb temperature must be above 36°F (2.2°C) before operating water pump.

IDC fan motors are suitable for variable frequency drive. A high quality pulse with modulating drive with proper precautions against voltage spikes, allows the motor to be run as low as 20 Hz. This will provide part load capacity by reducing unit airflow.

In winter operation, the Factory recommends that the pump should be the first item shut off to achieve capacity control. By running the unit with a "dry coil" during low wet bulb conditions, the unit is protected from ice formation.

Supplementary heat must be supplied to the pan water during freezing conditions. The evaporative condenser's basin heater provides sufficient heat to keep the spray water in the pan from freezing when the unit is not running. A thermostat that senses the pan water temperature controls the heater, and is factory set at 42°F (5.6°C).

The heater is protected by a low water cutout switch that prevents the heater from operating when the pan water level is too low. In addition to protecting the basin pan water, all exposed water piping, including the pump suction line, pump, pump discharge piping (up to the overflow connection), and the makeup water lines, should be traced with electrical heat tape and insulated. Some evaporative condenser installations will permit all spray water to be drained from the pan during cold weather operation. This permits dry operation of the Evaporative Cooler or Condenser when the load and ambient temperatures are extremely low.

Units that require year-round operation in a freezing climate (without a remote sump) should be equipped with an electric pan water level control package. This package ensures a constant water level without adjustment and also maintains very close control of the pan water level. The system consists of a weather-protected electric float switch with stilling chamber mounted on the pan section and a weather-protected solenoid valve mounted on the water makeup connection. When this system is used, it replaces the mechanical water makeup valve.

Section 4.0 Maintenance

4.1 Maintenance Intervals

Maintenance of the IDC is relatively easy if sufficient consideration is given to the minimum maintenance requirements for keeping evaporative-cooled condensers performing to specification. These can be easily scheduled using the following “easy reference” preventative maintenance guide provided below as **Figure 4-1. Recommended Maintenance Intervals**.

RECOMMENDED MAINTENANCE INTERVALS

TYPE OF SERVICE	START-UP	MONTHLY	EVERY 3 MONTHS	EVERY 6 MONTHS	EVERY 12 MONTHS
Inspect General Condition of Unit	X	X			
Clean debris from unit	X	X	X		
Clean and flush sump	X	X	X		
Clean sump strainer	X	X	X		
Check and adjust sump water level	X	X			
Inspect heat transfer section	X	X			
Inspect spray nozzles	X	X			
Check and adjust fan belt tension	X	X			
Check and adjust bleed rate	X	X			
Check operation of make-up valve	X	X			
Check unit for unusual noise or vibration	X	X			
Check fan bearing locking collars	X		X		
Check motor voltage current	X		X		
Lubricate fan shaft bearings	X	X	X		
Lubricate motor base adjusting screws	X		X		
Lubricate the fan and pump motors			X		
Check fan for rotation without obstruction	X	X			
Check fan & pump for proper rotation	X				
Drain sump and piping			X		
Inspect protective finish			X		
Lubricate capacity control and/or discharge closure damper bearings and working joints	X		X		X
Inspect/adjust damper linkage	X	X			X
Inspect electric pan water level control	X		X		X

Figure 4-1. Recommended Maintenance Intervals

NOTE: Before performing any maintenance or inspection, make certain that all power has been disconnected, locked out, and tagged properly.

4.2 Spare Parts Recommendations

Frick recommends that customers maintain the following spare parts "in stock" for the IDC evaporative-cooled condenser unit. By maintaining this inventory of spare parts, change-out requirements can be immediately satisfied during preventative maintenance inspections.

It is also advisable to reorder parts prior to taking existing spares from inventory. This policy helps prevents downtime due to "forgotten" spare parts order placement.

The type and recommended stock level for each part is listed below in **Figure 4-2. Recommended Spare Parts List**.

MODEL ______________________ SERIAL NUMBER ______________________

PART NUMBER	RECOMMENDED STOCK LEVEL
*FAN BELTS - ______________________	One Set
*FAN BEARINGS - ______________________	One Set
FAN BUSHING - ______________________	One Set
MOTOR BUSHING - ______________________	One Set
FAN SHEAVE - ______________________	One Set
MOTOR SHEAVE - ______________________	One Set
FLOAT VALVE - ______________________	One
SPRAY NOZZLES - ______________________	One Set
*FAN MOTOR - ______________________	One Set
*SPRAY PUMP - ______________________	One
FAN SHAFT - ______________________	One
* Parts noted to be considered as critical components to be stocked by customers to ensure continuous unit operation.	

Figure 4-2. Recommended Spare Parts List

4.3 Lubrication

Standard Motors

Standard IDC fan motors are specifically designed for this application to be maintenance free and no greasing is required. Replacement motors are available from the Factory. Part numbers can be found on the motor nameplate.

Special Motors

On occasion, special motors (i.e. two-speed, Chem Duty, etc.) may be specified. These motors must be maintained per the motor supplier's recommendations and may require external lubrication lines and special grease.

NOTE: The grease for special motor bearings and the fan bearings may not be compatible. Please check the lubrication label on the unit.

Fan Bearings

Check monthly and relubricate bearings (while bearings are being rotated). The grease will increase in temperature approximately 30°F (16.7°C) during relubrication. Use hand grease gun only.

Bearings used on the belt drive IDC units are prelubricated with grease chosen for its chemical and mechanical stability in an evaporitive-cooling environment. The type of grease used is lithium-complex based with synthetic oil. For relubrication, use any good quality lithium-based grease conforming to NLGI Grade No. 2 consistency.

The following types of grease meet the above criteria:

- MOBILITH 22
- MOBILUX #2
- SHELL ALVANIA #2
- UNIREX N2
- TEXACO MULTIFAX #2
- TEXACO PREMIUM RB

Grease and grease fittings should be free of dust, rust, metal particles, abrasives and chemical impurities such as free acid or free alkali.

4.4 Drivetrain

Belt tension should be checked every month as described in section 4.6. The sheaves should be tight on the shafts and should be aligned properly to minimize belt wear. The belts should be checked for wear along the edges, as any irregularity will cause vibration.

Sheave Inspection

Check the sheaves for proper alignment, excessive corrosion, and wear or damage. Also, check the belt for excessive heat. If the belt is too hot to touch, then the sheaves may be damaged or need aligning.

If the sheaves have excessive corrosion or are worn or damaged, they should be replaced. Check for sharp edges from wear or pitting of the grooves from corrosion. Either condition will promote belt wear and increase turnover. Groove gauges are also available to make it easy to see if the grooves are worn. If more than 1/32″ of wear can be seen, the sheave should be replaced.

Sheaves for the motor and fans are designed for this specialized application and are available from the Factory (do not substitute).

Alignment of sheaves is extremely important for proper belt installation. The sheaves are aligned at the factory, but should be rechecked when new belts are installed. Use a straight edge to check alignment. Misalignment will show up as a gap between the outside face and the straight edge. Two conditions for misalignment exist, angular and parallel.

To check both parallel and angular alignment, refer to **Figure 4-3. Sheave Alignment** and follow these instructions:

1. While placing a straight edge across the top of both motor and fan sheaves, check for four points of contact.
2. If a four-point contact is achieved, skip to the belt tensioning section.
3. To adjust for parallel misalignment, adjust the motor or fan shaft sheave.

Fan Blade Inspection

Inspect fan blades for damage or debris. Ensure aluminum blades are intact. Ensure that debris which can disturb fan balance is removed from fan.

4.5 Sump Drainage

The sump and piping should be drained every three months and the pump inlet screen should be cleaned. For units with integral pumps, the water pump inlet is equipped with a drain plug. Removing the plug allows the sump and pump screen to be cleaned and flushed. An FPT coupling is provided to allow piping to be attached as shown in **Figure 4-4. Sump Drain Location**.

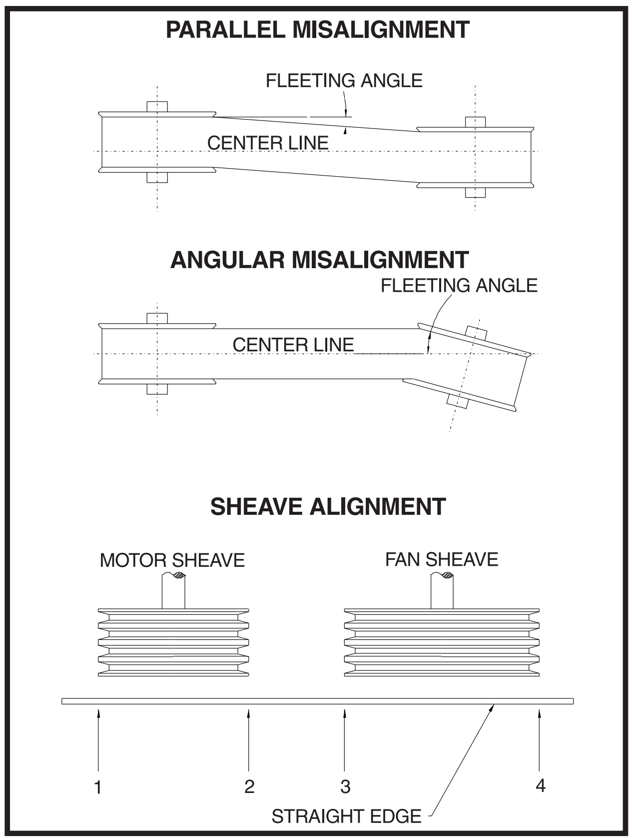


Figure 4-3. Sheave Alignment

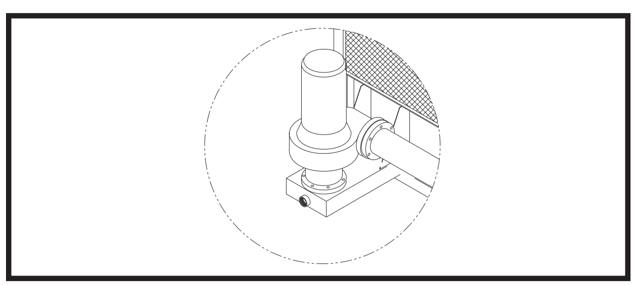


Figure 4-4. Sump Drain Location

4.6 Belt Replacement and Tensioning

Replacement

When the decision is made to replace the belt, follow these steps:

1. Lock out and tag the starter.
2. After the power has been turned off and the motor guard removed, loosen the motor mount adjustment nuts.
3. Move the motor until there is enough slack in the belt so it can be removed without prying.
4. Remove the old belts and inspect for unusual wear. Excessive wear may indicate problems with alignment or sheave damage.
5. Use replacement belts from the factory to ensure a proper belt equivalent.
6. Inspect other drive components such as bearings and sheaves for alignment, wear, lubrication, etc.
7. Clean the sheaves of debris before installing the new belt.
8. Install the new belt, align the drive, and tension the belt according to the procedures outlined here.

Tensioning

Proper belt tension is very important to ensure maximum belt life. If too little tension is applied, the belt will slip. Too much tension can reduce belt and bearing life. It is not recommended that belt dressing be used when belt slippage occurs as this will damage the belt and cause premature failure.

1. Decrease the center distance between the sheaves (by turning the tensioning nut counter clockwise) so the sheaves are somewhat loose.
2. Apply tension to the belt by turning the tensioning nut clockwise.
3. Operate the drive a few minutes to seat the belt in the sheave grooves. Observe the operation of the drive during start-up. A slight bowing of the slack side of the drive indicates proper tension. If the slack side remains taut during the peak load, the drive is to tight. Excessive bowing or slippage indicates insufficient tension. If the belt squeals as the motor comes on, it is not tight enough. The drive should be stopped and the belt tightened.

NOTE: Do not overtighten the drive.

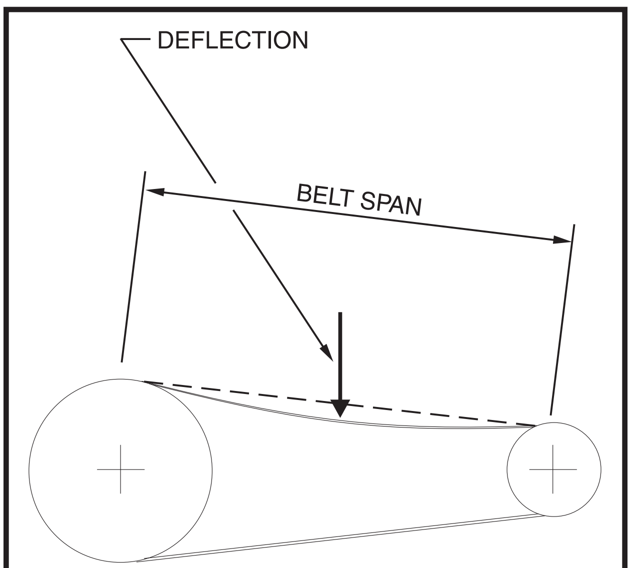


Figure 4-5. Belt Tensioning Schematic

4. If the above procedure still results in the belt squealing, but the belt is still taut on the slack side, a more precise method of testing the belt tension must be used. In this case, use a belt-tensioning gage available from V-belt drive manufacturers or from the Factory.

All belt tension measuring devices should include operating instructions. These are spring-loaded devices that use a hook to place tension on a stationary belt. Tension readings are observed at a point where the belt deflects a predetermined distance. Tension is usually applied at the belt span's mid-point as measured between the tangent of belt contact for both sheaves. Reference **Figure 4-5. Belt Tensioning Schematic.**

4.7 New Belt Run-in

During initial startup of new belts, a belt run-in procedure is recommended. During start-up, follow these instructions:

During start-up, look and listen for unusual noise or vibration.

1. After shutting down and locking out the starter, check the bearings and motor. If they feel hot, the belt tension may be too tight.
2. Run the drive under full load for 24 hours of continuous operation. Running the belts under full load allows them to seat themselves into the grooves.
3. After running the drive, check the tension of the belts. Retension to the recommended values. This run-in procedure will reduce the future need for re-tensioning and will help extend the life of the belts.

4.8 Coil Assembly

An evaporative-cooled condenser's operational readiness is dependent on the condition of the coil. Coils that are dirty, blocked from air-flow, or physically damaged may affect overall heat transfer capability of the IDC to a significant degree.

Periodically conduct a visual inspection of the coil section and refrigerant line connections. Remove any airborne debris that may have collected on the face of intake louvers or on the coils themselves. If separate air filtration exists prior to the intake louvers, ensure that adequate "free area" exists to meet intake-air CFM requirements.

Further need for cleaning or repair of an IDC coil should be left to the judgement of a certified or factory-trained service person. Contact the local Frick representative if a coil or its connections appears to have been significantly damaged.

4.9 Water Makeup Requirements

At its rated capacity (given in tons), an IDC unit will evaporate 3 gallons/min per 100 tons.

When the water evaporates, any impurities remain. Recirculating water flow then requires refreshing to prevent eventual scale build up. A bleed-off valve is located on the spray pump discharge line to bleed off an equal amount of water to that evaporated. (3 GPM per 100 tons)

For conditions where the original water hardness is very high or a large number of airborne contaminants may be washed into the recirculating spray water, a higher bleed-off rate or chemical treatment may be required. Consult a local water treatment company for recommendations.

4.10 Water Treatment

If the condition of the water is such that constant bleed-off will not control scale and/or control the recirculating water pH level within the acceptable range listed below, chemical treatment may be required. If a water treatment program is to be used, please consult a competent water treatment specialist, but use the following guideline as a minimum requirement:

- Chemicals must be compatible with zinc galvanic protection and maintained in proper concentration to be compatible with all materials of construction.
- The circulating water must be maintained between 6.5 and 8.0 pH at all times. Below 6.5, corrosion and/or accelerated consumption of protective zinc material will occur. When the pH reaches 8.3 or above, white rust may occur which will require passivation as discussed below.
- Maintain total dissolved solids below 1000 parts per million.
- Maintain alkalinity hardness between 100-300 parts per million.
- Maintain chlorides below 200 parts per million.
- Maintain sulfates below 250 parts per million.
- Chemicals should be fed into the recirculated water, but not into the cold water sump, on a continuous metered basis to avoid localized high concentrations which may cause corrosion. Batch feeding of chemicals does not provide adequate control of water quality and may lead to harmful concentration levels. Batch feeding is not recommended.
- Acid water treatment may be used but requires additional controls and significant caution. Acids are very harmful to galvanized surfaces, so the resulting pH levels must be closely monitored. Unfortunately, some water supplies provide highly alkaline water that can lead to white rust and must be tempered to more moderate pH levels. When acid treatment is required, sufficient feed controls must be put into place to maintain the pH of the water that comes into contact with the condenser components (coil, walls, sump, etc) within the aforementioned acceptable range. It is recommended that the chemical feed for acid treatment be done in a tank, such as a remote sump tank, that allows complete diffusion of the chemical before it is pumped to the unit. In addition to the chemical feed controls, regular inspections of feed valve and chemical levels should be included in the preventative maintenance plan to avoid chemical concentration of the water outside of the acceptable ranges listed above.
- The unit interior including the condenser walls above and below the coil, the coil and the sump basin should be inspected regularly. Signs of corrosion or excessive scale will highlight problems in the water treatment system. These must be addressed quickly to prevent significant damage to the protective galvanized surface.
- The use of simple bleed-off or chemical treatment for control of scale or corrosion does not preclude the need to control biological contamination. Treatment with biocide is a necessary part of required water treatment.

Upon initial commissioning of the equipment, passivation of the galvanized surfaces is required. As discussed above, when the pH levels are elevated during normal operation, the passivation process discussed below will be required. Passivation allows a galvanized surface to develop its protective layer of zinc carbonate and is an important part of the water treatment process. During passivation, operate the condenser as follows:

- Clean all surfaces.
- Maintain pH levels as close to 7.0 as possible. Do not allow the pH to fall below 6.5 or to rise above 7.5 at any time during passivation.
- Phosphate treatments can assist in the passivation process.
- Operate under minimal load. When the unit is installed, the water can be recirculated through the unit before refrigerant piping is connected to begin the passivation process.
- Maintain these conditions for a period of 30-45 days.
- **NOTE: if start-up does not allow for minimal load conditions for the required duration, the passivation can be repeated during the fall or winter following start-up.**

The following paragraphs contain specific and critical maintenance operations required for the components that make up the water circulation system.

Bleed-Off Valve

Check monthly to ensure that it is not blocked and that water is flowing as required. The bleed valve should always be open, unless the flow is controlled by a water treatment system.

Strainer

The pan water strainer is located at the bottom of the pan section at the suction connection of the spray pump. The strainer should be cleaned monthly, or as conditions require, to keep it clean. The strainer is easily accessible by removing the inlet louver at the pump end. Do not operate the unit without the strainer.

Makeup Valve

A float-actuated valve controls the pan-water level. This valve should be checked monthly for proper operation and water level. The pan water level should be even with the centerline of the overflow when the unit is not running. This will prevent the pump from cavitating when the spray system is in operation. The water level is easily adjusted by loosening the wing nut on the valve and raising or lowering the ball to maintain the proper level. The recommended operating pressure for the water makeup valve is 15 to 20 PSI.

Moisture Eliminators

The moisture eliminators are located on top of the unit and prevent losses of the spray water due to water being entrained in the air stream as it passes through the unit. The eliminators should be checked monthly to remove any obstructions that might be trapped between the blades and to ensure proper positioning.

Water Distribution System

The spray nozzles are accessible through the access door. After tagging and locking out the fan motor, remove a section of eliminators to find the spray header underneath (DO NOT OPERATE UNIT WITHOUT ELIMINATORS). The low pressure, large orifice, clog-resistant nozzles should be checked monthly to see that the spray pattern is complete and even. **Figure 4-6. Spray Header Nozzle Orientation**, shows the nozzle in the spray headers with the proper inline orientation.

If the nozzles are not operating properly, check that the strainer in the pan or that the water distribution pipes do not have accumulated dirt or debris. Also, check the nozzles by removing them and clean any that may need cleaning.

NOTE: When cleaning the nozzles and distribution system, always ensure that the initial orientation of the nozzles is maintained.

Heat Transfer Section

The coil should be examined monthly for signs of scale buildup, and any obstructions between the tubes should be removed. If there is evidence of scale buildup on the coil, check the bleed valve for adequate bleed-off. If the bleed-off valve is functioning properly, contact your local water treatment company for recommendations.

Pan-Water Electric Level Control Packages

Inspect Stilling Chamber for obstructions every three months.

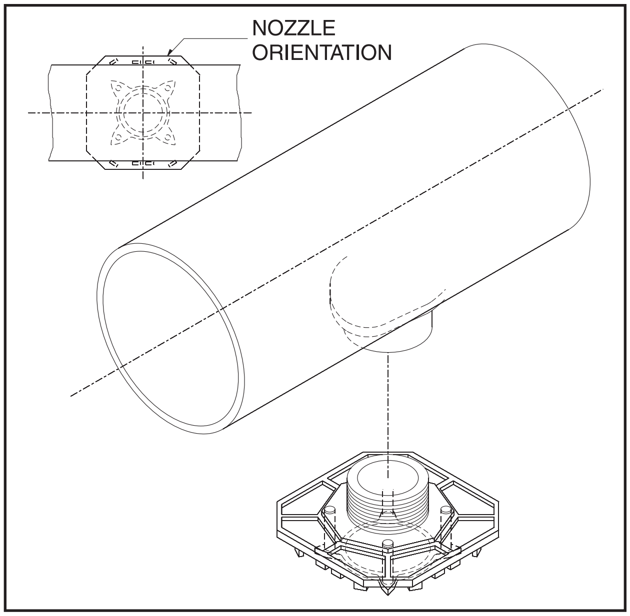


Figure 4-6. Spray Header Nozzle Orientation

4.11 Protective Finish

Standard IDC units are protected by a thick layer of hot dip galvanizing. it should be part of the maintenance program to annually inspect and “touch-up” any significant scratches that may penetrate the heavy layer of Zinc protection. Deep scratches should be cleaned of any surface soil, grease, etc., and then coated with a “zinc-rich” cold galvanizing compound or Zinc solder.

If surrounding components will not be damaged by flame-level heat, a blowtorch can be used to slowly heat the scratch to the melt point of a Zinc solder rod. Apply the Zinc until it smoothly flows over the scratch. Discontinue torch application and quickly use a manual wire brush to spread the molten Zinc evenly over the damaged area.

Care must be taken not to use this technique near any heat sensitive bearings, belts, mastic seals, etc. A “hot work” approval should be obtained from the work area’s designated Safety Officer before conducting the procedure.

Special units constructed from Stainless Steel components generally do not require “special care” to maintain normal corrosion protection. However, Stainless Steel units should be protected from direct exposure to caustic or acidic chemicals.

All units should be cleaned as local conditions require. Also, periodic inspections for structural or component damage from wind, lightening, or freezing weather will help maximize the unit’s life.

Section 5.0 Troubleshooting

Accurate troubleshooting is greatly facilitated by knowing proper unit capacities, dimensions, and other specifications. Detailed information for specific units is provided in the form of a drawing package shipped/submitted with the equipment delivery. Reference **Figure 5-1. IDC Series Standard Unit Specifications** and **Figure 5-2. IDC Series Standard Unit Dimensions** for basic design, capacities, and troubleshooting data for Imeco IDC units.

Once it is found that a unit is not performing to specifications, experienced maintenance personnel know that a methodical troubleshooting approach significantly reduces the time necessary to pinpoint appropriate responses. Use of the following troubleshooting guide is strongly recommended to minimize unnecessary repair costs and downtime.

The key to efficient use of the troubleshooting guide is to eliminate the simplest cause(s) until it is possible to isolate the specific problem/s that need to be rectified. For example, a five-minute determination of local ambient wet bulb temperature may prove that a unit is operating under extreme weather conditions. A maintenance troubleshooting "log" can prove invaluable in keeping up-to-date on such conditions and issues.

The following discussion details possible conditions and related causes for troubleshooting IDC condenser units:

5.1 Condition: High Condensing Pressure

Possible Cause # 1: IDC Unit / Cooling System Power Failure Or Brownout

- Check all fans, pumps, and control panels, for internal power distribution failures (such as blown fuses or overloads) or eliminate them from consideration. Also, determine if the utility or stand-by power supply back up has failed to supply adequate, consistent power. Should main or standby power supply equipment need updating, contact a local electrical expert or design/build contractor to provide for consistent power.

Possible Cause # 2: Excessive Wet Bulb Temperature

- Wet bulb temperature can be determined by using a "sling sychrometer" to take a reading near the inlet of the cooling tower/s. Background or ambient wet bulb is determined with the sling sychrometer at an upwind location or by cross-referencing local ambient "dry bulb" and humidity levels.
- If background wet bulb is in specification and the wet bulb at the inlet is out of specification – exhaust air recirculation may be excessive. Refer to the siting discussion provided in Section 1.0 and consult with the cooling system engineer to determine if re-siting or other cooling system changes are needed.

Possible Cause # 3: Insufficient Water Flow/Pressure To Spray Tree

- Check water flow and pressure at the IDC inlet pipe connection. Even if this was checked and confirmed at the time of start-up, changes to plant water supply or internal piping may have created additional pressure drops (line losses) between the pump/s and the spray tree connection.
- The IDC spray-piping tree requires 2-10 PSI at the connection at the flow rates (in GPM) specified for the unit. This information is available from the local representative.
- For remote pump applications, water must be supplied at the pressure and flow rate specified on the customer drawings.

Possible Cause # 4: Inadequate Water Distribution

- In the event that a few nozzles prove to be clogged or restricted, it may be necessary to remove the spray piping "tree" and clean all of the nozzles thoroughly (as discussed in Section 4.0 Maintenance). This will ensure that all nozzles are clean and properly realigned before re-installing the spray tree.

Possible Cause # 5: Low Fan Output

- Check fan voltage and amp draw readings and compare to specifications. If amp draw is excessive, check airflow pathways to ascertain that no restrictions exist. Restrictions may be blocking flow through intake louvers, eliminators, or the fan guard. Clear all air restrictions and rotate fan to check for binding blade tips in the orifice.
- If the fan has an adjustable-pitch propeller, check angle-of-attack adjustment location on each blade. All blades should have the same angle as specified for the unit. If amp draw is still low, increase the setting for all fins by a fraction of a degree and take new amp draw readings.

Possible Cause # 6: Inadequate Water Treatment

- Check scale buildup on coil. Scale buildup 1/32" thick can cause a 30% capacity reduction (as rated in cooling tons per hour).

Possible Cause # 7: Improperly Sized Or Applied Ancillary Component Or System Piping

- Check system piping against system designer's plans and specifications. Look for unusual mixed piping sizes/materials, excessive vertical/horizontal distances, "add-on" flow restricting devices, and poor quality pipe-fitting and support anchors.

Possible Cause # 8: IDC Unit Experiencing "Recirculation" Due To Improper Siting

- Recirculation of warm, moist exhaust air can rob up to 30% of the IDC unit's cooling capacity. Since this is a highly variable condition depending on weather conditions and the operational timing of nearby cooling units, plant maintenance is encouraged to consult with the cooling system design engineer.
- Generally speaking, an IDC unit should be located above roof level, as far away as possible from other exhaust stacks, and upwind of higher wind-diverting structures. Any diversion from these rules-of-thumb should be re-examined by the system design engineer.

Possible Cause # 9: Noncondensables In Receiver or Condenser

- Check condenser and receiver to determine if non-condensables have contaminated the system. If non-condensables are found, proceed with repairs as prescribed by the refrigeration equipment/system supplier (e.g., evacuating the refrigerant lines/system and recharging after eliminating leak or source of contamination).

5.2 Condition: Excessive Deposits, Scale, Or Turbidity

Possible Cause # 1: Inadequate Filtration Or Treatment Of Spray Water

- Filtration is an inherent requirement for evaporative cooling systems due to the concentration of dissolved solids and "washing" of air particulate. Recommended filters types include bag, mesh, centrifugal, and sand & gravel.
- Filtration equipment must be maintained regularly. All filters (partial/side flow designs in particular) must be cleaned or back-flushed regularly.
- In the event that plant-cooling system seems to have inadequate filtration, Imeco recommends that the system design engineer consult with a local water treatment expert. Until the situation is resolved, blow-down rates should

be increased to eliminate as much excess particulate as possible.

Possible Cause # 2: Water pH is Out Of Range

- pH must be less than 9.0 and greater than 6.5. Water treatment equipment is designed to slug feed biocides of various pH levels to minimize bacterial counts. Skimping on chemical will allow algae blooms and high bacterial counts. Excessive or chlorine based biocides may lower pH and shorten the life of Zinc-protected steel components.
- Calibrate biocide chemical injection rate. Drain system and make-up with clean water to rebalance pH. Run system for 24 hours and observe any change in pH range.
- Repeat above steps and determine if process is adding bases/acids or is in some way affecting overall pH levels in the cooling water flow. Eliminate any leaks (process-to-cooling-water) that may be changing pH levels in the water flow.

5.3 Condition: Excessive Slime Plugging Water Air Passages

Possible Cause # 1: Low Blow-down Rate

- Calibrate IDC cooling water blow-down controls. Readjust if necessary to meet requirements specified by cooling system design engineer.

Possible Cause # 2: High Bacterial Count

- Take sample for lab analysis. If analysis indicates high bacterial count, start by physically removing excess slime. Calibrate chemical biocide feed. Drain water from system and make-up with fresh supply before returning system to service.

Possible Cause # 3: High Nutrient Levels

- Take sample for analysis. If analysis indicates excessive nutrients, repeat above steps.
- Take samples during operation to determine if source of nutrients is airborne or leaked from process by heat exchanger, etc. Eliminate source or increase blow-down rates accordingly if discharge permit allows.

5.4 Condition: Low or High Water Level

Possible Cause # 1: Drain/Overflow Piping Clogged

- Remove debris and refill basin to test flow.

Possible Cause # 2: Makeup Valve Malfunctioning

- Replace makeup valve assembly and refill basin to operating level.

Possible Cause # 3: Pump Output Incorrect

- Take flows and pressure readings from pump/piping in question. Determine if pump may be throttled with means of butterfly valve. Make necessary throttle adjustments and check basin after (1) hour of operation.

Possible Cause # 4: Equipment/Piping Leak

- Make-up water pressure too high (maximum should be no more than 60 PSI). If necessary, install regulator in city water makeup piping.
- Inspect all equipment and piping for water leak. If found, shut off system. Fix leak or bypass if possible before returning system to operation.

5.5 Condition: Excessive Noise or Vibration

Possible Cause # 1: Debris-laden Fan Blades

- Clean/remove debris from fan and retest unit operation.

Possible Cause # 2: Improperly Aligned Drive Components

- Inspect fan and drive assembly for improperly aligned drive components. Replace failed components and realign drive assembly per maintenance instructions.

Possible Cause # 3: Damaged Noise Control Device

- Check device for damage to insulation, door, wall panels, or damaged inlet louvers.

Possible Cause # 4: Loose Tower Components

- Inspect for loose components/fasteners and repair or replace as necessary.

Possible Cause # 5: Out Of Specification Fan Speed

- Determine actual drive ratio by turning fan slowly by hand and comparing the number of motor sheave revolutions for one revolution of the fan. Multiply actual ratio by the speed (RPM) noted on the IDC unit's motor nameplate.
- Contact factory for order information regarding original fan speed. If different than actual, replace existing, improper replacement sheaves or belt.

Possible Cause # 6: Out Of Specification IDC Unit Structural Steel or Supports

- Failed structural steel/support beams, isolators, or attaching hardware. Replace any component having excess corrosion or fatigued connections.

Possible Cause # 7: Excessive Background Noise/ Refraction

- Turn off IDC and have accurate sound readings taken during "noisy" hours of operation. Turn on IDC and take simultaneous readings with unit in operation. If background noise exceeds IDC sound levels, consider sound isolation of background noise sources.

			FAN	SPRAY	PUMP	REMOTE SUMP			DIMENSIONS		REFRIG.	WEIGHTS		
IDC MODEL	NH_3 TONS	CFM	MOTOR HP	WATER GPM	MOTOR HP	WATER IN	SUMP DRAIN	GALLONS REQUIRED	HEIGHT H	CTRS B	CHARGE NH_3 LB	UNIT SHIPPING	UNIT OPERATING	HEAVIEST SECTION
420	297.9	81,297	15	715	5	6" PE	10" PE	600	186.00	30.25	425	16,099	22,511	11,957
435	308.5	84,866	20	715	5	6" PE	10" PE	600	186.00	30.25	425	16,199	22,611	12,057
450	319.1	88,567	25	715	5	6" PE	10" PE	600	186.00	30.25	425	16,299	22,711	12,157
490	347.5	84,602	20	715	5	6" PE	10" PE	600	193.25	37.50	530	18,196	24,829	14,054
505	358.1	87,245	25	715	5	6" PE	10" PE	600	193.25	37.50	530	18,296	24,929	14,154
520	368.8	82,090	25	715	5	6" PE	10" PE	600	200.00	44.25	640	20,262	27,117	16,192
540	383.0	87,245	30	715	5	6" PE	10" PE	600	200.00	44.25	640	20,362	27,217	16,292
575	407.8	105,237	15	1,050	7.5	6" PE	10" PE	900	186.00	30.25	640	24,173	33,800	17,953
615	436.2	115,820	20	1,050	7.5	6" PE	10" PE	900	186.00	30.25	640	24,273	33,900	18,053
645	457.4	124,806	25	1,050	7.5	6" PE	10" PE	900	186.00	30.25	640	24,373	34,000	18,153
670	475.2	132,594	30	1,050	7.5	6" PE	10" PE	900	186.00	30.25	640	24,473	34,100	18,253
700	496.4	117,018	20	1,050	7.5	6" PE	10" PE	900	193.25	37.50	800	27,322	37,281	21,102
735	521.3	125,805	25	1,050	7.5	6" PE	10" PE	900	193.25	37.50	800	27,422	37,381	10,202
765	542.5	133,792	30	1,050	7.5	6" PE	10" PE	900	193.25	37.50	800	27,522	37,481	21,302
800	567.4	127,402	30	1,050	7.5	6" PE	10" PE	900	200.00	44.25	960	30,423	40,716	24,313
835	592.2	133,792	40	1,050	7.5	6" PE	10" PE	900	200.00	44.25	960	30,523	40,816	24,413
870	617.0	153,000	40	1,050	7.5	6" PE	10" PE	900	193.25	37.50	890	32,222	44,065	24,183
895	634.8	141,700	30	1,050	7.5	6" PE	10" PE	900	200.00	44.25	1,070	35,123	47,300	27,833
940	666.7	153,000	40	1,050	7.5	6" PE	10" PE	900	200.00	44.25	1,070	35,243	47,420	27,953
955	677.3	164,140	50	1,050	7.5	6" PE	10" PE	900	200.00	44.25	1,070	35,343	47,520	28,013
990	702.2	164,140	50	1,100	10	6" PE	10" PE	900	200.00	44.25	1,070	35,343	47,520	28,013
840-2E	595.8	162,594	(2)15	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	198.00	30.25	850	32,198	45,022	11,957
870-2E	617.0	169,732	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	198.00	30.25	850	32,398	45,222	12,057
900-2E	638.2	177,134	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	198.00	30.25	850	32,598	45,422	12,157
980-2E	695.0	169,204	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	205.25	37.50	1,060	36,393	49,658	14,054
1010-2E	716.2	174,490	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	205.25	37.50	1,060	36,592	49,858	14,154
1040-2E	737.6	164,180	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	212.00	44.25	1,280	40,523	54,234	16,192
1080-2E	766.0	174,490	(2)30	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	212.00	44.25	1,280	40,724	54,434	16,292
1150-2E	815.6	210,474	(2)15	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,346	67,600	17,953
1230-2E	872.4	231,640	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,546	67,800	18,053
1290-2E	914.8	249,612	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,746	68,000	18,153
1340-2E	950.4	265,188	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,946	68,200	18,253
1400-2E	992.8	234,036	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,600	54,644	74,562	21,102
1470-2E	1042.6	251,610	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,600	54,844	74,762	21,202
1530-2E	1085.0	267,584	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,600	55,044	74,962	21,302
1600-2E	1134.8	254,804	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	1,920	60,846	81,432	24,313
1670-2E	1184.4	267,584	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	1,920	61,046	81,632	24,413
1740-2E	1234.0	306,000	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,780	64,444	88,130	24,183
1790-2E	1269.5	283,400	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,246	94,600	27,833
1880-2E	1333.3	306,000	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,486	94,840	27,953
1910-2E	1354.6	328,280	(2)50	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,665	95,019	28,013
1980-2E	1404.4	328,280	(2)50	2,200	(2)10	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,686	95,040	28,013
840-2S	595.8	162,594	(2)15	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	198.00	30.25	850	32,198	45,022	11,957
870-2S	617.0	169,732	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	198.00	30.25	850	32,398	45,222	12,057
900-2S	638.2	177,134	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	198.00	30.25	850	32,598	45,422	12,157
980-2S	695.0	169,204	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	205.25	37.50	1,060	36,393	49,658	14,054
1010-2S	716.2	174,490	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	205.25	37.50	1,060	36,592	49,858	14,154
1040-2S	737.6	164,180	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	212.00	44.25	1,280	40,523	54,234	16,192
1080-2S	766.0	174,490	(2)30	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	212.00	44.25	1,280	40,724	54,434	16,292
1120-2S	794.3	200,070	(2)15	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,346	67,600	17,953
1200-2S	851.1	220,020	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,546	67,800	18,053
1260-2S	893.6	237,120	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,746	68,000	18,153
1300-2S	922.0	251,940	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	198.00	30.25	1,280	48,946	68,200	18,253
1360-2S	964.5	222,300	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,600	54,644	74,562	21,102
1430-2S	1014.2	239,020	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,600	54,844	74,762	21,202
1490-2S	1056.7	254,220	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,600	55,044	74,962	21,302
1560-2S	1106.4	242,060	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	1,920	60,846	81,432	24,313
1620-2S	1148.9	254,220	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	1,920	61,046	81,632	24,413
1690-2S	1198.6	281,520	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	205.25	37.50	1,780	64,444	88,130	24,183
1745-2S	1234.0	260,730	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,246	94,600	27,833
1810-2S	1283.7	281,520	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,486	94,840	27,953
1840-2S	1304.1	302,020	(2)50	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,665	95,019	28,013
1920-2S	1352.1	302,020	(2)50	2,200	(2)10	(2)6" PE	(2)10" PE	1,800	212.00	44.25	2,140	70,686	95,040	28,013
1620-4Q	1148.9	305,690	(4)15	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	198.00	30.25	1,700	64,396	90,044	11,957
1670-4Q	1184.4	319,230	(4)20	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	198.00	30.25	1,700	64,796	90,444	12,057
1730-4Q	1227.0	333,140	(4)25	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	198.00	30.25	1,700	65,196	90,844	12,157
1880-4Q	1333.3	318,100	(4)20	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	205.25	37.50	2,120	72,784	99,316	14,054
1940-4Q	1375.9	328,250	(4)25	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	205.25	37.50	2,120	73,184	99,716	14,154
2000-4Q	1418.4	308,700	(4)25	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	212.00	44.25	2,560	81,048	108,468	16,192
2080-4Q	1475.2	328,250	(4)30	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	212.00	44.25	2,560	81,448	108,868	16,292
2190-4Q	1553.2	395,930	(4)15	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	198.00	30.25	2,560	96,692	135,200	17,953
2340-4Q	1659.6	435,410	(4)20	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	198.00	30.25	2,560	97,092	135,600	18,053
2450-4Q	1737.6	469,250	(4)25	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	198.00	30.25	2,560	97,500	136,000	18,153
2550-4Q	1808.5	498,580	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	198.00	30.25	2,560	97,892	136,400	18,253
2660-4Q	1886.5	439,920	(4)20	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	205.25	37.50	3,200	109,288	149,124	21,102
2790-4Q	1978.7	473,010	(4)25	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	205.25	37.50	3,200	109,688	149,524	21,202
2910-4Q	2063.8	503,090	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	205.25	37.50	3,200	110,088	149,924	21,302
3040-4Q	2156.0	479,030	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	212.00	44.25	3,840	121,692	162,864	24,313
3170-4Q	2248.2	503,090	(4)40	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	212.00	44.25	3,840	122,092	163,264	24,413
3270-4Q	2319.1	575,280	(4)40	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	205.25	37.50	3,560	128,888	176,260	24,183
3370-4Q	2390.1	532,800	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	212.00	44.25	4,280	140,492	189,200	27,833
3540-4Q	2510.6	575,280	(4)40	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	212.00	44.25	4,280	140,972	189,680	27,953
3610-4Q	2550.5	620,500	(4)50	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	212.00	44.25	4,280	141,330	190,038	28,013
3740-4Q	2652.5	620,500	(4)50	4,400	(4)10	(4)6" PE	(4)10" PE	3,600	212.00	44.25	4,280	141,372	190,080	28,013

Figure 5-1. Standard IDC Series Unit Specifications

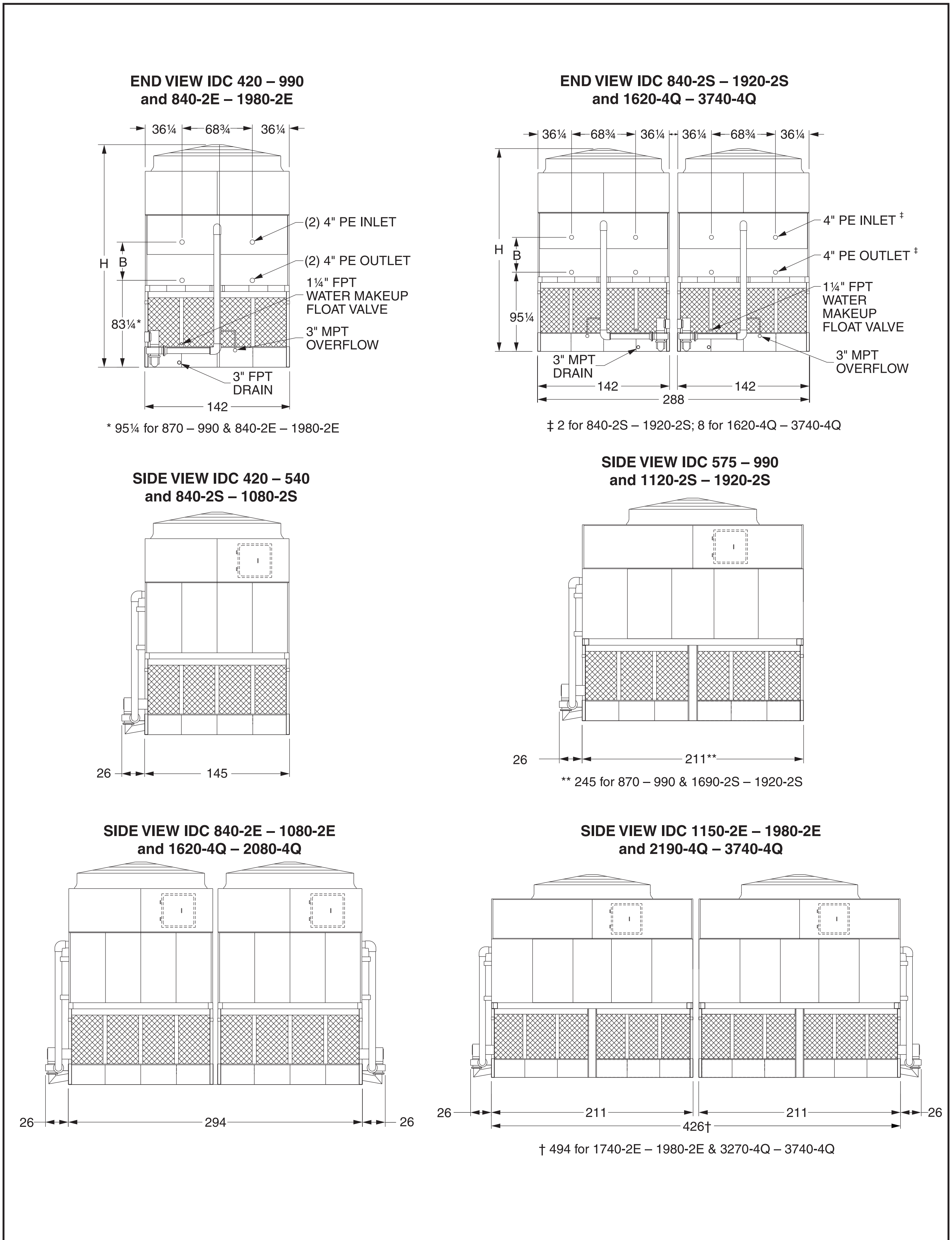


Figure 5-2. Standard IDC Series Unit Dimensions

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- Q-NET™ distributed architecture mean faster, easier, economical installations
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